

IN THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A data processing device comprising:
an improvement information generating unit adapted to generate improvement information for improving quality of data; and
an embedding unit adapted to embed a plurality of types of improvement information into the data, wherein the improvement information generating unit generates the plurality of types of improvement information for converting the data into a plurality of qualities, and
wherein the embedding unit embeds the plurality of types of improvement information into the data so that the data and the improvement information can be restored.

2. (Previously Presented) The data processing device as claimed in claim 1, wherein the improvement information generating unit generates a prediction coefficient used for predicting a prediction value of quality-improved data obtained by improving the quality of the data, as the improvement information.

3. (Previously Presented) The data processing device as claimed in claim 2, wherein the improvement information generating unit generates the prediction coefficient for each predetermined class.

4. (Previously Presented) The data processing device as claimed in claim 3, wherein the improvement information generating unit comprises:

 a class tap constructing unit adapted to construct a class tap used for finding a class of target teacher data of teacher data to be a teacher, by using learner data to be a learner;

 a classifying unit adapted to carry out classification for finding the class among the target teacher data on a basis of the class tap;

 a prediction tap constructing unit adapted to construct a prediction tap used together with the prediction coefficient for predicting the target teacher data, by using the learner data; and

 a prediction coefficient operation unit adapted to find the prediction coefficient for each class by using the teacher data and the prediction tap.

5. (Previously Presented) The data processing device as claimed in claim 4, wherein the improvement information generating unit generates a plurality of types of improvement information.

6. (Previously Presented) The data processing device as claimed in claim 5, wherein the improvement information generating unit generates prediction coefficients for different number of classes as the plurality of types of improvement information.

7. (Previously Presented) The data processing device as claimed in claim 5, wherein the improvement information generating unit generates a plurality of types of prediction coefficients found by using learner data or teacher data of different qualities, as the plurality of types of improvement information.

8. (Previously Presented) The data processing device as claimed in claim 5, wherein the improvement information generating unit generates at least the prediction coefficient and information for carrying out linear interpolation, as the plurality of types of improvement information.

9. (Previously Presented) The data processing device as claimed in claim 5, wherein the improvement information generating unit generates a plurality of types of prediction coefficients found by using class taps or prediction taps of different structures, as the plurality of types of improvement information.

10. (Previously Presented) The data processing device as claimed in claim 5, wherein the improvement information generating unit generates a plurality of types of prediction coefficients

found by carrying out classification by different methods, as the plurality of types of improvement information.

11. (Previously Presented) The data processing device as claimed in claim 1, wherein the improvement information generating unit generates, as the improvement information, a class code expressing the class of the data, used for predicting the prediction value of the quality-improved data obtained by improving the quality of the data.

12. (Previously Presented) The data processing device as claimed in claim 11, wherein the improvement information generating unit comprises:

 a prediction tap constructing unit adapted to construct a prediction tap used for predicting target teacher data of teacher data to be a teacher, by using learner data to be a learner;

 a prediction coefficient storage unit adapted to store a prediction coefficient for each class code found by learning;

 a predictive operation unit adapted to find a prediction value of the target teacher data by using the prediction tap and the prediction coefficient; and

 a class code detecting unit adapted to detect the class code of a prediction coefficient that minimizes the prediction value of the target teacher data; and

 wherein the improvement information generating unit outputs the class code detected by the class code detecting unit, as the improvement information.

13. (Previously Presented) The data processing device as claimed in claim 11, wherein the improvement information generating unit comprises:

a class tap constructing unit adapted to generate a class tap used for finding the class of target teacher data of teacher data to be a teacher, by using the teacher data; and

a classifying unit adapted to carry out classification for finding the class of the target teacher data on the basis of the class tap; and

wherein the improvement information generating unit outputs a class code corresponding to the class found by the classifying unit, as the improvement information.

14. (Previously Presented) The data processing device as claimed in claim 1, wherein the embedding unit embeds the improvement information into the data so that the data and the improvement information can be restored, by using a bias of energy held by the data.

15. (Previously Presented) The data processing device as claimed in claim 1, wherein the embedding unit embeds the improvement information into the data by carrying out spectrum spreading.

16. (Previously Presented) The data processing device as claimed in claim 1, wherein the embedding unit embeds the improvement information into the data by changing one or more bits of the data to the improvement information.

17. (Original) The data processing device as claimed in claim 1, wherein the data is image data and the improvement information is information for improving image quality of the image data.

18. (Currently Amended) A data processing method comprising:
an improvement information generating step of generating improvement information for improving quality of data; and
an embedding step of embedding a plurality of types of improvement information into the data, wherein the improvement information generating step generates the plurality of types of improvement information for converting the data into a plurality of qualities and,
wherein the embedding step embeds the plurality of types of improvement information
into the data so that the data and the improvement information can be restored.

19. (Currently Amended) A recording medium having recorded thereon a program to be executed by a computer, the program comprising:

an improvement information generating step of generating improvement information for improving quality of data; and
an embedding step of embedding a plurality of types of improvement information into the data, wherein the improvement information generating step generates the plurality of types of improvement information for converting the data into a plurality of qualities and,

wherein the embedding step embeds the plurality of types of improvement information into the data so that the data and the improvement information can be restored.

20. (Cancelled)

21. (Currently Amended) A data processing device for processing embedded data obtained by embedding a plurality of types of improvement information for improving quality of data into the data, the device comprising:

an extracting unit adapted to extract the plurality of types of improvement information from the embedded data; and

an improving unit adapted to improve the quality of the data by using one of the plurality of types of improvement information according to a user request and

wherein the plurality of types of improvement information are embedded into the data so that the data and the improvement information can be restored.

22. (Previously Presented) The data processing device as claimed in claim 21, wherein the improvement information is a prediction coefficient used for predicting a prediction value of quality-improved data obtained by improving the quality of the data, and the improving unit finds the prediction value of the quality-improved data by using the data and the prediction coefficient.

23. (Previously Presented) The data processing device as claimed in claim 22, wherein the improvement information is a prediction coefficient found for each predetermined class, and the improving unit finds the prediction value of the quality-improved data by using the data and the prediction coefficient for each class.

24. (Previously Presented) The data processing device as claimed in claim 23, wherein the improving unit comprises:

 a class tap constructing unit adapted to construct a class tap used for finding a class of target quality-improved data, which is targeted quality-improved data, by using the data;

 a classifying unit adapted to carry out classification for finding the class of the target quality-improved data on the basis of the class tap;

 a prediction tap constructing unit adapted to construct a prediction tap used together with a prediction coefficient for predicting the target quality-improved data, by using the data; and

 a predicting unit adapted to find a prediction value of the target quality-improved data by using the prediction coefficient of the class of the target quality-improved data and the prediction tap.

25. (Previously Presented) The data processing device as claimed in claim 21, wherein the improvement information is a class code expressing the class of a prediction coefficient for each predetermined class used for predicting a prediction value of quality-improved data obtained by

improving the quality of data, and the improving unit finds the prediction value of the quality-improved data by using the data and the prediction coefficient corresponding to the class code.

26. (Previously Presented) The data processing device as claimed in claim 25, wherein the improving unit comprises:

a prediction tap constructing unit adapted to construct a prediction tap used together with a prediction coefficient for predicting target quality-improved data, which is targeted quality-improved data, by using the data; and

a predicting unit adapted to predict a prediction value of the target quality-improved data by using the prediction coefficient corresponding to the class code as the improvement information and the prediction tap.

27. (Original) The data processing device as claimed in claim 24, wherein a plurality of types of improvement information are embedded in the embedded data.

28. (Original) The data processing device as claimed in claim 27, wherein the prediction coefficients for different numbers of classes are embedded in the embedded data as the plurality of types of improvement information.

29. (Original) The data processing device as claimed in claim 27, wherein the prediction coefficient is generated by using learner data to be a learner and teacher data to be a teacher, and

a plurality of types of prediction coefficients found by using learner data or teacher data of different qualities are embedded in the embedded data as the plurality of types of improvement information.

30. (Original) The data processing device as claimed in claim 27, wherein at least the prediction coefficient and information for carrying out linear interpolation are embedded in the embedded data as the plurality of types of improvement information.

31. (Original) The data processing device as claimed in claim 27, wherein a plurality of types of prediction coefficients found by using class taps or prediction taps of different structures are embedded in the embedded data as the plurality of types of improvement information.

32. (Original) The data processing device as claimed in claim 27, wherein a plurality of types of prediction coefficients found by carrying out classification by different methods are embedded in the embedded data as the plurality of types of improvement information.

33. (Previously Presented) The data processing device as claimed in claim 27, further comprising an improvement information selecting unit adapted to select improvement information used for improving the quality of the data, from the plurality of types of improvement information.

34. (Previously Presented) The data processing device as claimed in claim 21, wherein the extracting unit extracts the improvement information from the embedded data by using the bias of energy held by the data.

35. (Previously Presented) The data processing device as claimed in claim 21, wherein the extracting unit extracts the improvement information from the embedded data by carrying out inverse spectrum spreading.

36. (Previously Presented) The data processing device as claimed in claim 21, wherein the extracting unit extracts one or more bits of the embedded data as the improvement information.

37. (Original) The data processing device as claimed in claim 21, wherein the data is image data and the improvement information is information for improving the image quality of the image data.

38. (Currently Amended) A data processing method for processing embedded data obtained by embedding a plurality of types of improvement information for improving quality of data into the data, the method comprising:

an extracting step of extracting the plurality of types of improvement information from the embedded data; and

an improving step of improving the quality of the data by using one of the plurality of types of improvement information according to a user request and

wherein the plurality of types of improvement information are embedded into the data so that the data and the improvement information can be restored.

39. (Currently Amended) A recording medium having recorded thereon a program to be executed by a computer for processing embedded data obtained by embedding a plurality of types of improvement information for improving the quality of data into the data, the program comprising:

an extracting step of extracting the plurality of types of improvement information from the embedded data; and

an improving step of improving the quality of the data by using one of the plurality of types of improvement information according to a user request and

wherein the plurality of types of improvement information are embedded into the data so that the data and the improvement information can be restored.

40. (Cancelled)

41. (Currently Amended) A data processing device comprising:

an improvement information generating unit adapted to generate a plurality of types of improvement information for improving quality of data, wherein one of the plurality of types of improvement information is embedded into the data;

an improvement information selecting unit adapted to select improvement information to be transmitted together with the data, from the plurality of types of improvement information; and;

a transmitting unit adapted to transmit the data and said one of the plurality of types of improvement information and,

wherein said one of the plurality of types of improvement information is embedded into the data so that the data and the improvement information can be restored.

42. (Previously Presented) The data processing device as claimed in claim 41, further comprising improvement information selecting unit for selecting improvement information to be transmitted together with the data, from the plurality of types of improvement information.

43. (Previously Presented) The data processing device as claimed in claim 42, wherein the improvement information selecting unit selects the improvement information in response to a request from a receiving device which receives the data.

44. (Previously Presented) The data processing device as claimed in claim 43, further comprising an accounting unit adapted to carry out accounting in correspondence with the improvement information selected by the improvement information selecting unit.

45. (Previously Presented) The data processing device as claimed in claim 41, wherein the improvement information generating unit generates at least a prediction coefficient used for predicting a prediction value of quality-improved data obtained by improving the quality of the data, as the improvement information.

46. (Previously Presented) The data processing device as claimed in claim 45, wherein the improvement information generating unit generates a prediction coefficient for each predetermined class.

47. (Previously Presented) The data processing device as claimed in claim 46, wherein the improvement information generating unit comprises:

 a class tap constructing unit adapted to construct a class tap used for finding the class of target teacher data of teacher data to be a teacher, by using learner data to be a learner;

 a classifying unit adapted to carry out classification for finding the class of the target teacher data on the basis of the class tap;

 a prediction tap constructing unit adapted to construct a prediction tap used together with a prediction coefficient for predicting the target teacher data, by using the learner data; and

a prediction coefficient operation unit adapted to find a prediction coefficient for each class by using the teacher data and the prediction tap.

48. (Previously Presented) The data processing device as claimed in claim 47, wherein the improvement information generating unit generates prediction coefficients for different numbers of classes as the plurality of types of improvement information.

49. (Previously Presented) The data processing device as claimed in claim 47, wherein the improvement information generating unit generates a plurality of types of prediction coefficients found by using learner data or teacher data of different qualities, as the plurality of types of improvement information.

50. (Previously Presented) The data processing device as claimed in claim 47, wherein the improvement information generating unit generates at least the prediction coefficient and information for carrying out linear interpolation, as the plurality of types of improvement information.

51. (Previously Presented) The data processing device as claimed in claim 47, wherein the improvement information generating unit generates a plurality of types of prediction coefficients found by using class taps or prediction taps of different structures, as the plurality of types of improvement information.

52. (Previously Presented) The data processing device as claimed in claim 47, wherein the improvement information generating unit generates a plurality of types of prediction coefficients found by carrying out classification by different methods, as the plurality of types of improvement information.

53. (Previously Presented) The data processing device as claimed in claim 41, wherein the transmitting unit embeds the improvement information into the data so that the data and the improvement information can be restored, by using the bias of energy held by the data, and transmits the data and one or more types of improvement information.

54. (Previously Presented) The data processing device as claimed in claim 41, wherein the transmitting unit embeds the improvement information into the data by carrying out spectrum spreading and transmits the data and one or more types of improvement information.

55. (Previously Presented) The data processing device as claimed in claim 41, wherein the transmitting unit embeds the improvement information into the data by changing one or more bits of the data to the improvement information and transmits the data and one or more types of improvement information.

56. (Previously Presented) The data processing device as claimed in claim 41, wherein the transmitting unit transmits the data and all the plurality of types of improvement information.

57. (Original) The data processing device as claimed in claim 41, wherein the data is image data and the improvement information is information for improving the image quality of the image data.

58. (Currently Amended) A data processing method comprising:

an improvement information generating step of generating a plurality of types of improvement information for improving quality of data;

an improvement information selecting unit adapted to select improvement information to be transmitted together with the data, from the plurality of types of improvement information, wherein one of the plurality of types of improvement information is embedded into the data; and;

a transmitting step of transmitting the data and said one of the plurality of types of improvement information and,

wherein said one of the plurality of types of improvement information is embedded into the data so that the data and the improvement information can be restored.

59. (Currently Amended) A recording medium having recorded thereon a program to be executed by a computer, the program comprising:

an improvement information generating step of generating a plurality of types of improvement information for improving the quality of data;

an improvement information selecting unit adapted to select improvement information to be transmitted together with the data, from the plurality of types of improvement information, wherein one of the plurality of types of improvement information is embedded into the data; and;

a transmitting step of transmitting the data and said one of the plurality of types of improvement information and,

wherein said one of the plurality of types of improvement information is embedded into the data so that the data and the improvement information can be restored.

60. (Cancelled)

61. (Previously Presented) A data processing device comprising:

an improvement information generating unit adapted to generate improvement information for improving quality of data; and

an embedding unit adapted to embed improvement information into the data, wherein the embedding unit embeds the improvement information into the data so that the data and the improvement information can be restored, by using a bias of energy held by the data.

62. (Previously Presented) A data processing device for processing embedded data obtained by embedding improvement information for improving quality of data into the data, the device comprising:

an extracting unit adapted to extract the improvement information from the embedded data; and

an improving unit adapted to improve the quality of the data by using the improvement information, wherein the extracting unit extracts the improvement information from the embedded data by using the bias of energy held by the data.

63. (Previously Presented) A data processing device comprising:

an improvement information generating unit adapted to generate a plurality of types of improvement information for improving quality of data;

an improvement information selecting unit for selecting improvement information to be transmitted together with the data, from the plurality of types of improvement information; and

a transmitting unit adapted to transmit the data and one or more types of improvement information, wherein the improvement information selecting unit selects the improvement information in response to a request from a receiving device which receives the data.

64. (Previously Presented) A data processing device comprising:

an improvement information generating unit adapted to generate a plurality of types of improvement information for improving quality of data;

an improvement information selecting unit for selecting improvement information to be transmitted together with the data, from the plurality of types of improvement information;

a transmitting unit adapted to transmit the data and one or more types of improvement information; and

an accounting unit adapted to carry out accounting in correspondence with the improvement information selected by the improvement information selecting unit, wherein the improvement information selecting unit selects the improvement information in response to a request from a receiving device which receives the data.

65. (Previously Presented) A data processing device comprising:

an improvement information generating unit adapted to generate a plurality of types of improvement information for improving quality of data; and

a transmitting unit adapted to transmit the data and one or more types of improvement information, wherein the transmitting unit embeds the improvement information into the data so that the data and the improvement information can be restored, by using the bias of energy held by the data, and transmits the data and one or more types of improvement information.